# Hypotheses

It takes many skills to design and carry out good scientific experiments. The scientific method involves asking a good question, making a hypothesis, conducting research, identifying and controlling variables, making observations during testing, collecting data, and drawing conclusions. Using data sheets, diagrams, and graphs helps you organize and present your results. These skills help make your experiments reliable, repeatable, and meaningful.

## Purpose

To write a testable hypothesis, to compare the hypothesis with the results, and to write a new hypothesis, based on the results.

## Process Skills

Observe, measure, collect data, interpret data, communicate, form a hypothesis, draw conclusions

## Background

When scientists conduct an **experiment**, they often follow the **scientific method**. The scientific method begins with a **research question** and a **hypothesis**. Hypotheses are statements that **predict** an outcome and provide an explanation for an experiment, based on prior knowledge and research. Hypotheses are often written using an "if . . . then . . . because" format. A hypothesis provides an answer to the research question and must be **testable**.

Scientists test a hypothesis by running experiments and making **observations**. Then they **analyze** the results, or **data**. After all these steps, they can draw a **conclusion**. The conclusion is an explanation of whether or not the results supported the hypothesis. In this activity, you will practice writing a hypothesis for a simple test using gummy candies. After the experiment, you will decide if the results supported your hypothesis. Then you will write a new hypothesis, based on your results.

**Time –** Part 1: 20 minutes; Part 2: 20 minutes

**Grouping –** Small groups

**Materials**
(per group)

- ❑ gummy candies in five colors: clear, yellow, orange, red, green
- ❑ 5 condiment cups
- ❑ water
- ❑ plastic spoon
- ❑ paper plate
- ❑ paper towels
- ❑ ruler with cm and mm markings
- ❑ Data Sheets 1 and 2 (one set per student)

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## Procedure

In most experiments, you will focus on the science ideas you are testing. But in this experiment, you will mainly focus on the hypothesis. The important steps will be writing a hypothesis, judging whether or not your hypothesis is supported by the results of the experiment, and considering new hypotheses for future testing. The boxes below provide background information to help you write a hypothesis.

**Background Research:**
Three primary ingredients in gummy candy are sugar, gelatin, and food coloring.

**Research Question:** Will gummy candies of different colors change size if left in water for one day?

**Elements of a good hypothesis:** is written as a statement, makes a prediction, is testable, provides an explanation, fits with existing observations

### *Part 1: Write a Hypothesis and Conduct the Experiment*

1. Read the information in the boxes above. With your group, discuss what you think will happen to a gummy candy if it is left in water for one day. Will the gummy candy get bigger or smaller? Will it dissolve? After deciding what you think will happen, discuss why you think it will happen.
2. Write your hypothesis. On Data Sheet 1, complete the "if . . . then . . . because" statement.
3. Measure the length of each of your gummy candies before placing them in water. Choose the longest length of each candy, which may be top to bottom or side to side. Record your measurements in the table on Data Sheet 1. [**NOTE:** Do not eat the gummy candies, as these are research subjects and will be handled by multiple people.]
4. Place one gummy candy of each color into the condiment cups. Fill each cup to the top with water.
5. After one day, carefully remove your gummy candies from their cups using a plastic spoon. Place them on a paper plate. Measure each gummy candy the same way as in Step 3, and record your measurements on Data Sheet 1. Record any additional observations at the bottom of Data Sheet 1, including whether or not you observed differences between the various colors of gummy candies.
6. Clean up your work area. Keep Data Sheet 1 as a reference to use during *Part 2: Reflection.*

### *Part 2: Reflection*

With your group, use Data Sheet 2 to reflect on your hypothesis and consider a new hypothesis for a future experiment. Use the questions and tips in the table as a guide.

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Name_____ Date_____

**Part 1:** Write a Hypothesis and Conduct the Experiment

**Research Question:** Will gummy candies of different colors change size if left in water for one day?

**Hypothesis:**

*If* _____

*then* _____

*because* _____

**Collect Data**

| Gummy candy color | Length before placing in water (cm) | Length after one day in water (cm) |
|---|---|---|
|  clear | | |
| yellow  | | |
|  orange | | |
| red  | | |
|  green | | |

**Observations:** Write about what you observed after the gummy candies were left in water for one day, including any differences you observed among the various colors.

_____

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_____

_____

_____

Name_____ Date_____

**Part 2:** Reflection

Using the information from Data Sheet 1, work with your group to complete each of the parts below.

| |
|---|
| Summary of experiment: What is the answer to the research question? Explain. |
| Compare results to hypothesis: Did the results support the hypothesis? Explain why or why not. (Review the hypothesis and compare it to the results.) |
| New research question: List one idea for a future experiment related to this one that you would like to try. |
| New hypothesis: Using the "if . . . then . . . because" format, make a new hypothesis for the new question you just wrote. |

Name_____ Date_____

## Critical Thinking

**1.** What is a hypothesis?

**2.** Why is it important to include a "because" statement when making a hypothesis?

**3.** Do the results of an experiment have to match the hypothesis? Why or why not?

**4.** Why is it useful to know how to make hypotheses? Think about careers that require this skill.